भारतीय मानक
Indian Standard

IS 2314 (Part 1) : 2023

इस्पात की चादर की पाइलिंग — विशिष्टि

भाग 1 तप्त बेलित चादर की पाइल

(दूसरा पुनरीक्षण)

Steel Sheet Piling Section — Specification

Part 1 Hot Rolled Sheet Pile

(Second Revision)

ICS 77.140.70

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September 2023 **Price Group 9**

Structural Engineering and Structural Sections Sectional Committee, CED 07

FOREWORD

This Indian Standard (Part 1) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Structural Engineering and Structural Sections Sectional Committee had been approved by the Civil Engineering Division Council.

This standard is one of a series of Indian Standards being published under the Steel Economy Programme. The object of this programme is to achieve economy in the use of steel by establishing rational, efficient and optimum standards for structural sections; formulation of standard codes of practice for design and fabrication of steel structures; popularization of welding in steel construction and co-ordination; and sponsoring of experimental research relating to production and use of structural steel which would enable formulation and revision of specifications and codes of practice.

Piling sections are required in large quantities for coastal protection, hydroelectric, irrigation, power, dock and underground railway projects, etc. Necessity was, therefore, felt to standardize piling sections for manufacturing these in the country.

Sheet piles are used for various purposes. Some of the important aspects in the use of sheet piles are:

a) Their resistance to bending forces which depends on shape and section moduli of the sections;

b) Ease with which piling sections can be driven and reclaimed for re-use, if required, even after a few years of service;

c) Efficiency and water-tightness of the inter-locking arrangement at the joints; and

d) Feasibility of economical rolling in the country.

This standard was first published in 1963 and subsequently revised in 1987, which contained only three types of sections, that is Z-type, U-type and flat-type piling sections, which are formed by hot rolling. In its first amendment in 2016, piling section formed by cold rolling were introduced. In this revision, the committee decided to separate the standard in two parts as follows:

Part 1 Hot rolled sheet pile
Part 2 Cold formed sheet pile

In this part, following modifications have been effected:

a) New sections (H-type and Hat-type) have been added;

b) Provision relating to tolerances have been updated; and

c) Provision relating to testing of piling section has been added.

In the formulation of this standard, assistance has been derived from the following publications:

EN 10248-1 : 1996 Hot rolled sheet piling of non alloy steels — Part 1: Technical delivery conditions

EN10248-2 : 1996 Hot rolled sheet piling of non alloy steels — Part 2: Tolerances on shape and dimensions

JIS A 5523 : 2012 Weldable hot rolled steel sheet piles

JIS A 5528 : 2012 Hot rolled steel sheet piles

The composition of the Committee responsible for the formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard.

Indian Standard

STEEL SHEET PILING SECTION — SPECIFICATION

PART 1 HOT ROLLED SHEET PILE

(Second Revision)

1 SCOPE

1.1 This standard covers the requirements for Z-type, U-type, flat-type, H-Type and Hat-Type profile of hot rolled steel sheet piling.

1.2 Sectional properties of some of these sections as calculated with the nominal dimensions are also included.

2 REFERENCES

The standards given below contain provisions, which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards:

IS No.	*Title*
IS 1608 (Part 1) : 2022/ISO 6892-1 : 2019	Metallic materials — Tensile testing: Part 1 Method of test at room temperature (*fifth revision*)
IS 1956 (Part 3) : 2019	Glossary of terms relating to iron and steel: Part 3 Long products including bars rods sections and wires (*second revision*)
IS 2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (*seventh revision*)

3 TERMINOLOGY

For the purpose of this standard the terms and definitions given in IS 1956 (Part 3) shall apply.

4 MATERIAL

4.1 Piling sections shall be made from steel conforming to IS 2062.

4.2 Where steel is required in copper bearing quality, the copper content shall be between 0.20 percentage and 0.35 percentage.

5 CLASSIFICATION

5.1 Steel sheet piles shall be classified as follows in accordance with the cross- sectional shapes of the sections:

a) Z-type — Roughly Z-shape with joints of piles when driven located alternately at inner and outer sides of the piling wall.

b) U-type — Roughly U-shape with joints of piles when driven located on the neutral axis of the piling wall.

c) Flat-type — Having flat shape with high resistance to tensile forces.

d) H-type — Having H shape.

e) Hat-type — Having Hat shape.

6 DESIGNATION

6.1 Steel sheet piling sections conforming to this specifications shall be designated with the letters ISPS followed by the section modulus per metre of wall in cm^3 and letter symbols Z, U, F, H and Hat which denote Z-type, U-type, flat-type, H-type and Hat-type and sections respectively.

7 PROFILE

7.1 Profile of Z-type piling sections shall be as per Fig. 1.

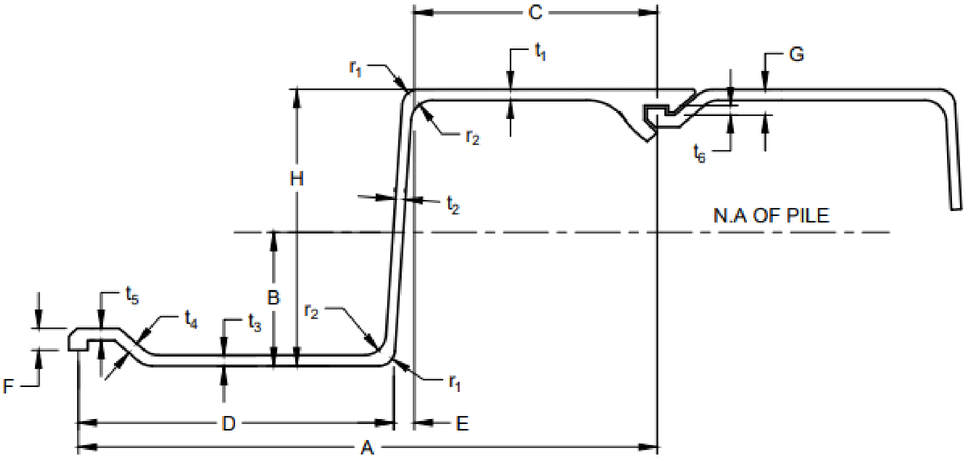


FIG. 1 Z-TYPE PILING SECTION

7.2 Profile of U-Type piling sections shall be as per Fig. 2.

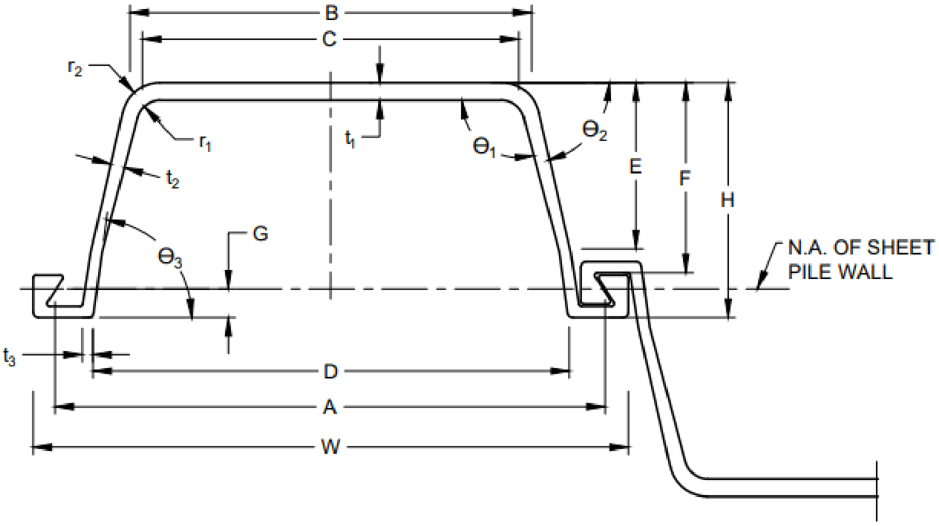


FIG. 2 U-TYPE PILING SECTION

7.3 Profile of flat-type piling sections shall be as per Fig. 3.

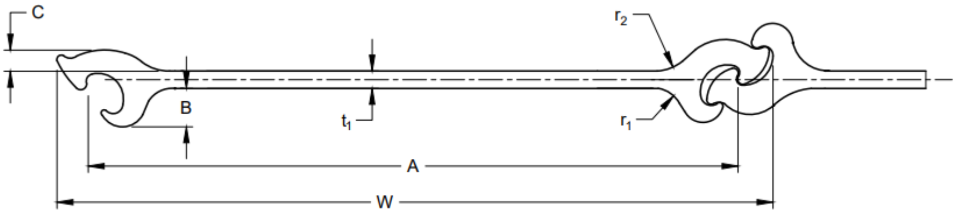


FIG. 3 FLAT-TYPE PILING SECTION

7.4 Profile of H-type piling sections shall be as per Fig. 4.

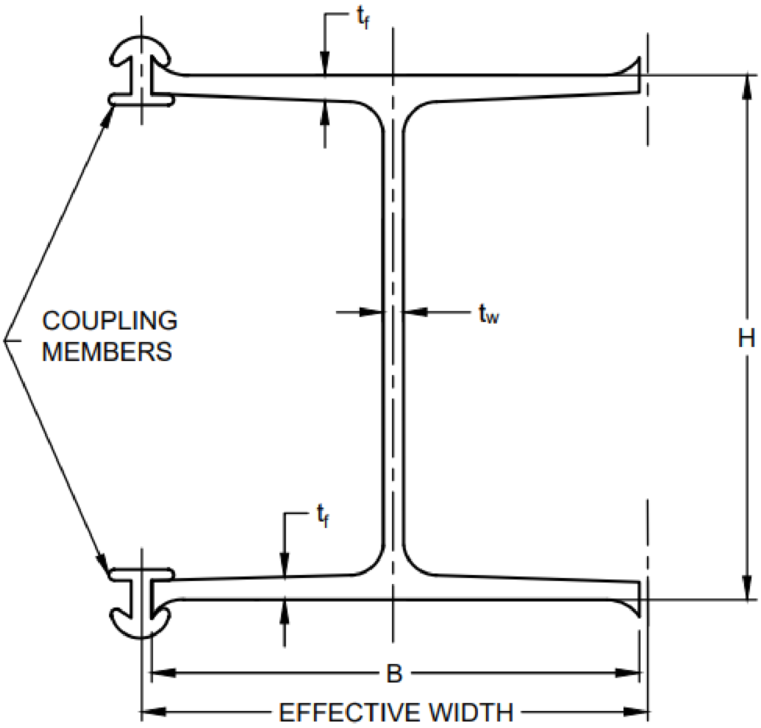


FIG. 4 H-TYPE SECTION PILING

7.5 Profile of Hat-type piling sections shall be as per Fig. 5.

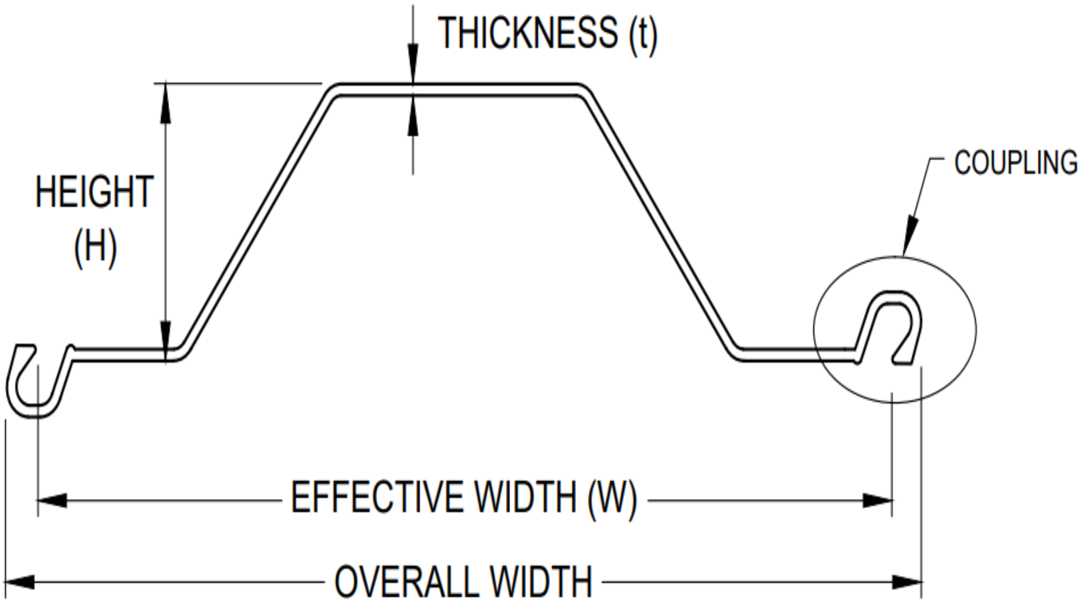


FIG. 5 HAT-TYPE SECTION PILING

7.6 The Typical dimensions and approximate calculated sectional properties, based on the nominal dimensions, for the Z, U, flat types, H-types and Hat-types of sheet piling sections are given in Annex A.

7.7 The geometry of the profile of the section may be mutually decided between the manufacturer and the client.

8 REQUIREMENTS

8.1 Dimensional Requirements

8.1.1 *Dimensional Tolerances*

Tolerances for widths (*W*), heights (*H*), thicknesses (*t*) and camber of Z-type, U-type, flat-type and other type steel sheet piling sections shall be as given in Table 1.

Table 1 Dimensional Tolerance

(*Clause* 8.1.1)

Sl No. (1)	Description (2)	Z-Type (3)	U-Type (4)	Flat-Type (5)	Hat-Type (6)	H-Type (7)
i)	Width, *W*	+5.0	+5.0	+ 4.0	+10	+ 4
		-5.0	-5.0	- 4.0	- 5	- 4
ii)	Height, *H*	+ 4.0	+ 4.0	-	± 4.0 percent	± 1.0 percent
		- 4.0	- 4.0	-		
iii)	Thickness, *t*					
	$t < 10$	+ 1.0	+ 1.0	+ 1.5	+ 1.0	+ 1.0
		- 1.0	- 1.0	- 1.0	- 1.0	- 1.0
	$10 < t < 16$	+ 1.2	+ 1.2	+ 1.75	+ 1.2	+ 1.2
		- 1.2	- 1.2	- 1.75	- 1.2	- 1.2
	$t > 16$		–		+ 1.5	+ 1.5
					- 1.5	- 1.5
iv)	Camber	0.20 percent of length			0.25 percent of length	0.20 percent of length

NOTES

1 Width, *W* stands for all the linear dimensions of the sections.

2 Thickness, *t* stands for the various thicknesses of sections.

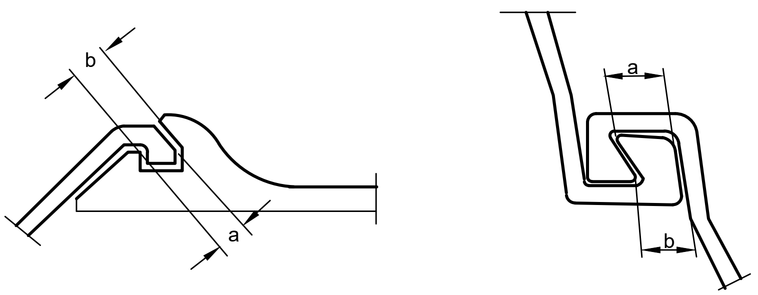
8.2 Tolerances on Design Dimensions

8.2.1 Interlock shall meet the following essential requirements:

a) The interlocks shall fit with adequate free play so that the piles can easily be fitted into each other, and

b) The interlocks shall be so designed that the piles are firmly engaged despite the free play.

8.2.2 The tolerances as given in Table 2 for the piling sections over the design dimensions at interlocks, as shown in Fig. 6, shall be followed to ensure the requirements specified in **8.2.1**.



TYPE 1

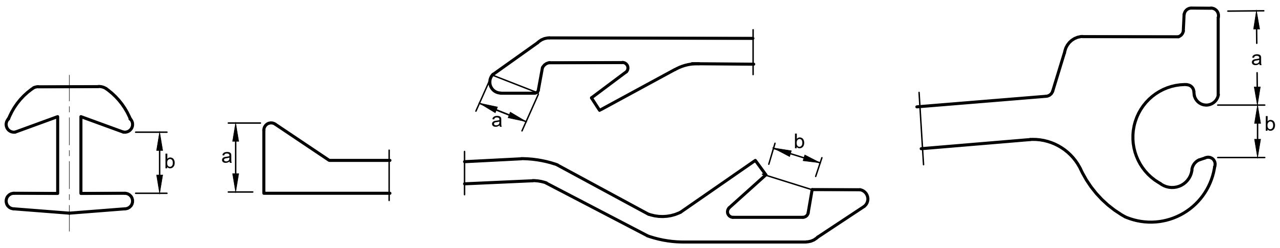
a - BUTTON WIDTH
b -INTERLOCK OPENING
TOLERANCE: a-b ≥ 4

TYPE 2

a - BUTTON WIDTH
b - INTERLOCK OPENING
TOLERANCE: a-b ≥ 4

TYPE 3

a - BUTTON WIDTH
b - INTERLOCK OPENING
TOLERANCE: a-b ≥ 7



TYPE 4

a - CLUB HEIGHT
b - INTERLOCK OPENING
TOLERANCE: a-b ≥ 4

TYPE 5

a - CLUB HEIGHT
b - INTERLOCK OPENING
TOLERANCE: a-b ≥ 4

TYPE 6

a - CLUB HEIGHT
b - INTERLOCK OPENING
TOLERANCE: a-b ≥ 4

FIG. 6 INTERLOCK DIMENSIONS, a AND b

Table 2 Tolerances on Design Dimensions

(*Clause* 8.2.2)

Sl No.	Type	Design Dimension	Tolerance on Design Dimension	
			mm	mm
(1)	(2)	(3)	(4)	(5)
i)	Type 1 and Type 4	Button width/club height, *a*	+1.0	-3.0
		Interlock opening, *b*	+3.0	-1.0
ii)	Type 2 and Type 5	Button width/club height, *a*	+2.5	-2.5
		Interlock opening, *b*	+2.0	-2.0
iii)	Type 3 and Type 6	Button width/club height, *a*	+2.0	-3.0
		Interlock opening, *b*	+3.0	-2.0

8.3 Tolerance on Mass

The tolerance on mass shall be + 4 percent and - 2.5 percent.

8.4 Tolerance on Length

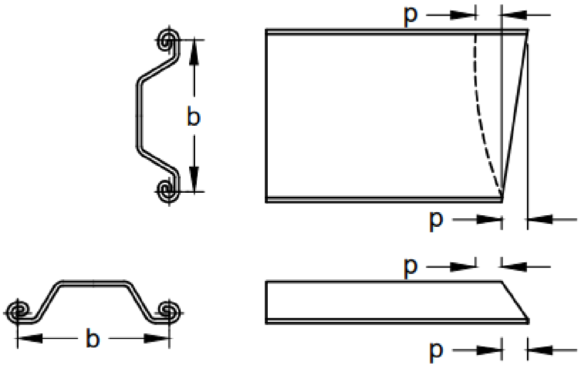
Tolerance on length shall be + 75 mm and - 50 mm.

8.6 Squareness Tolerance

The squareness tolerance and dimensions is given in Table 3.

Table 3 Squareness of Ends for All Profiles

(*Clause* 8.6)

Sl No. (1)	Designation (2)	Figure (3)	Nominal Dimension (4)	Tolerance (5)
i)	*p*		All widths	± 2 % *b*

8.7 Deviation Angle

Each interlock allows acertain rotation. The minimum angle of coupling mating joint (the theoretical interlock swing, α_{Max}) for the combination of the identical versions of Z-type are 5° and combination of the identicalversions of U-type sheet piles are 5°.

9 SURFACE DEFECTS

9.1 Steel sheet piles shall not show defects under use. Surface defects may be repaired either by grinding or welding as specified in **10**.

9.2 Steel sheet piles shall be straight and the cut and surface shall be flat.

9.3 The material shall be sound and free from any surface flaws which might preclude its use for the purpose for which it is intended.

10 SURFACE REPAIRS

10.1 Repair of surface defects shall be done either by grinding or by welding as specified in **10.1.1** and **10.1.2**.

10.1.1 *Repair by Grinding*

Repair of surface defects by grinding shall comply with the following conditions:

a) The depth of ground portions shall be within the minus range of thickness tolerance, and

b) The ground portions shall be finished neat.

10.1.2 *Repair by Welding*

Repair of surface defects by welding shall comply with the following conditions:

a) Prior to welding, defects shall be removed completely by chipping, grinding or other suitable methods and their depth shall not be more than 20 percent of thickness of the parent metal. The aggregate of the surface area repaired by welding shall not exceed 2 percent of the total surface area of the sheet piling section.

b) Portions repaired by welding shall be sound. Provisions of extra thickness shall not be less than 1.5 mm above the surface of the steel sheet pile and shall be removed by chipping or grinding to a clean finish flush with the height of the surface.

11 STRENGTH OF JOINT

11.1 Flat type steel sheet piles shall be tested in accordance with Annex B and the tensile strength of joints of flat-type sheet piles shall be as agreed upon between the purchaser and the manufacturer.

12 PACKING AND MARKING

12.1 Products may be supplied in securely tied bundles. In this case, the marking shall be on a label securely attached to the bundle or fixed to the top product of the bundle.

12.2 Marking shall be as per IS 2062. Any additional requirement may be agreed at the time of the enquiry and order.

13 BIS CERTIFICATION MARKING

The sheet pile conforming to the requirements of this standard may be certified as per the conformity assessment scheme under the provisions the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder, and the products may be marked with Standard Mark.

ANNEX A

(*Clause* 7.6)

NOMINAL DIMENSION AND SECTIONAL PROPERTIES

A-1 The nominal dimension of some of the Z-type, U-type, flat-type, H-type and Hat-type piling section are given in Table 4, Table 5, Table 6, Table 7 and Table 8 respectively (*see* Fig. 1, 2, 3, 4 and 5).

Table 4 Nominal Dimensions of Z-Type Piling Sections

(*Clause* A-1)

All dimensions in millimetres.

Sl No.	Designation	H	A	B	C	D	E	F	G	t_1	t_2	t_3	t_4	t_5	t_6	r_1	r_2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	Hot Rolled Sections																
i)	ISPS 1021 Z	185.0	400	92.5	165.0	221.0	14.0	20.0	20.0	8.5	7.5	8.5	9.5	9.5	9.5	12.0	16.0
ii)	ISPS 1481 Z	210.0	400	105.0	165.0	220.0	15.0	23.0	23.0	11.5	8.5	11.5	12.5	12.5	12.5	14.0	18.0
iii)	ISPS 1888 Z	235.0	400	117.5	165.0	218.0	17.0	24.5	24.5	13.0	9.5	13.0	14.0	14.0	14.0	15.0	20.0
iv)	ISPS 2322 Z	260.0	400	130.0	165.0	217.0	18.0	25.5	25.5	14.0	10.5	14.0	15.0	15.0	15.0	16.0	20.0

NOTE — Clutch dimension has not been specified and is left to the discretion of the manufacturer.

Table 5 Nominal Dimensions of U-Type Piling Sections

(*Clause* A-1)

All dimensions in millimetres.

Sl No (1)	**Designation** (2)	***W*** (3)	***H*** (4)	***A*** (5)	***B*** (6)	***C*** (7)	***D*** (8)	***E*** (9)	***F*** (10)	***G*** (11)	t_1 (12)	t_2 (13)	t_3 (14)	θ_1 (15)	θ_2 (16)	θ_3 (17)	r_1 (18)	r_{12} (19)
	Hot Rolled Sections																	
i)	ISPS 1625 U	437	172.0	402.5	295.7	275.8	347.5	124.5	139.2	20.9	13	9.0	8.2	105	77	82.5	17.0	28
ii)	ISPS 2222 U	458	194.5	402.5	304.0	282.0	364.5	147.2	161.0	21.8	14	9.5	8.5	105	77	82.5	28.0	35
iii)	ISPS 2770 U	458	193.0	402.0	304.0	284.5	364.0	147.2	159.5	22.5	22	10	10.5	105	77	82.5	28.5	35

NOTE — Clutch dimension has not been specified and is left to the discretion of the manufacturer.

Table 6 Nominal Dimensions of Flat-Type Piling Sections

(*Clause* A-1)

All dimensions in millimetres.

Sl No. (1)	**Designation** (2)	***W*** (3)	***A*** (4)	***B*** (5)	***C*** (6)	t (7)	r_1 (8)	r_2 (9)
i)	ISPS 100 F	445.0	400.0	40.0	25.0	9.0	13.0	18.0

NOTE — Clutch dimension has not been specified and is left to the discretion of the manufacturer.

Table 7 Nominal Dimensions of H-Type Piling Sections

(*Clause* A-1)

All dimensions in millimetres.

Sl No. (1)	**Designation** (2)	***H*** (3)	***B*** (4)	t_f (5)	t_w (6)
i)	ISPS 389 H	200	205	9.0	9.0
ii)	ISPS 546 H	210	225	11.0	11.0
iii)	ISPS 855 H	249	265	12.0	12.0
iv)	ISPS 1531 H	308	311	15.4	15.3
v)	ISPS 1638 H	311	308	16.0	16.0
vi)	ISPS 2468 H	356	376	17.9	17.8
vii)	ISPS 3474 H	368	400	24.0	24.0

Table 8 Nominal Dimensions of Hat-Type Piling Sections

(*Clause* A-1)

All dimensions in millimetres.

Sl No. (1)	Designation (2)	*W* (3)	*H* (4)	*t* (5)
i)	ISPS 902 HAT	900	230	10.8
ii)	ISPS 1610 HAT	900	300	13.2
iii)	ISPS 2450 HAT	900	368	15.0
iv)	ISPS 2760 HAT	900	370	17.0

A-2 The sectional properties of hot rolled sheet piling sections are given in Table 9.

Table 9 Mass and Geometrical Properties of Sheet Piling Sections

(*Clause* A-2)

Sl No.	**Designation**	**Mass per Metre** kg	**Mass per Square Metre of Wall** kg	**Sectional Modulus per Metre of Wall** cm^3	**Moment of Inertia per Metre of Wall** cm^4	**Sectional Area per Metre of Wall** cm^2	**Perimeter per Metre of Wall** cm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	ISPS 1021 Z	49.2	123.1	1 021	9 448	157	283
ii)	ISPS 1481 Z	63.8	159.5	1 481	15 548	203	295
iii)	ISPS 1888 Z	73.2	183.1	1 888	22 184	233	307
iv)	ISPS 2322 Z	81.6	204.1	2 322	30 189	260	318
v)	ISPS 1625 Z	65.4	162.4	1 625	24 563	207	308
vi)	ISPS 2222 Z	82.7	195.7	2 222	38 219	249	331
vii)	ISPS 2770 U	95.0	226.0	2 770	47 500	288	330
viii)	ISPS 100 F	55.2	138.0	100	428	176	104
ix)	ISPS 902 HAT	86.4	96.0	902	10 500	122.2	-
x)	ISPS 1610 HAT	113	126	1 610	24 400	160.4	-
xi)	ISPS 2450 HAT	147	163	2 450	45 000	207.8	-
xii)	ISPS 2760 HAT	167	186	2 760	51 100	236.3	-

Table 9 (*Concluded*)

Sl No. (1)	Designation (2)	Mass per Metre kg (3)	Mass per Square Metre of Wall kg (4)	Sectional Modulus per Metre of Wall cm^3 (5)	Moment of Inertia per Metre of Wall cm^4 (6)	Sectional Area per Metre of Wall cm^2 (7)	Perimeter per Meter of Wall cm (8)
xiii)	ISPS 389 H	42.5	-	389	3 888	54.1	118
xiv)	ISPS 546 H	57.2	-	546	5 729	72.9	127
xv)	ISPS 855 H	75.0	-	855	10 650	95.5	149
xvi)	ISPS 1531 H	110	-	1 531	23 560	140	180
xvii)	ISPS 1638 H	117	-	1 638	25 480	150	178
xviii)	ISPS 2468 H	152	-	2 468	43 970	194	215
xiv)	ISPS 3474 H	213	-	3 474	63 920	271	226

ANNEX B

(*Clause* 11.1)

TESILE TEST OF FLAT TYPE SHEET PILE

B-1 COUPLING TENSILE TEST ON FLAT TYPE SHEET PILE

B-1.1 The coupling tensile test on flat type sheet pile shall be as follows:

a) Two coupling tensile test pieces shall be taken at right angle to the rolling direction from each lot of the same sectional dimensions. In this case, the dimensions of one test piece shall be 100 mm in width and 300 mm in length, and each one of the pair shall have a coupling on one side and thus representing the coupling on both side of sheet pile.

b) The tensile test shall be carried out by measuring the disengagement strength of joint (the breaking strength if the test pieces breaks before the disengagement of the joint) in accordance with IS 1608. In this case, the test piece shall be set in such a manner that the two couplings engage each other with the tensile axis parallel to the axis of the test pieces, as given in the Fig. 7. The distance between grips shall be not less than 400 mm.

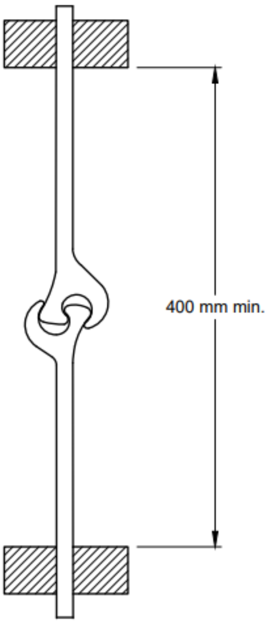


FIG. 7 TENSILE TEST SET UP

ANNEX C

(*Foreword*)

COMMITTEE COMPOSTION

Structural Engineering and Structural Sections Sectional Committee, CED 07

Organization	*Representative(s)*
In Personal Capacity (*Block 2, Flat 2A Rani Meyyammai Tower, MRC Nagar, RA Puram, Chennai - 600028*)	DR V. KALYANARAMAN **(*Chairperson*)**
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